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38. Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics, Drury College, Springfield, Missouri.

Two arrows are sticking in a circular target: show that the chance that their distance is greater than the radius of the target is $3\sqrt{3}/4\pi$. [From *Todhunter's Integral Calculus*, page 335.]

MISCELLANEOUS.

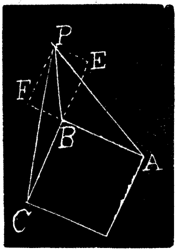
Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

33. Proposed by Prof. ALEXANDER ROSS, C. E., Sebastopol, California.

From a point P without a square field ABC, the distances PA, PB, and PC measured to the corners are, respectively, 70, 40, and 60 chains. What is the area of the field ?

I. Solution by A. H. BELL, Hillsboro, Illinois, and A. H. HOLMES, Brunswick, Maine.



Let $a>b>c$ equal the distances 70, 60, and 40, and let $x=a$ side of the square field. Then $\cos A=\dfrac{a^2+x^2-c^2}{2ax}$, and this multiplied by $a=AF=\dfrac{a^2+x^2-c^2}{2x}$. $AF-AB=BF=EP=\dfrac{a^2-c^2-x^2}{2x}$; then, also, $BE=\dfrac{b^2-c^2-x^2}{2x}$.

$$\therefore\ \frac{(a^2-c^2-x^2)^2+(b^2-c^2-x^2)^2}{4x^2}=c^2\ \ldots\ldots\ldots\ldots\ldots(1).$$

$$x^4-(a^2+b^2)x^2=c^2(a^2+b^2)-\frac{a^4+b^4+2c^4}{2}\ \ldots\ldots\ldots(2).$$

$$\text{Area of square}=x^2=\tfrac{1}{2}\left[a^2+b^2\pm\sqrt{4c^2(d^2+b^2-c^2)-(a^2-b^2)^2}\right]\ldots.(3).$$

Then area required$=(8500\pm6516.901)\div2=750.84\tfrac{1}{2}$ or 99.155 acres.

The second is the value required ; the other is for point within the field.

II. Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Applied Science, Texarkana College, Texarkana, Arkansas-Texas.

Let $ABCD$ be the square, $OA=70=a$, $OB=40=c$, $OC=60=b$, O the origin, (x, y) co-ordinates of A, (u, v) co-ordinates of C, $\angle ABE=\theta$, $\angle EBC=\dfrac{\pi}{2}-\theta$.

$$\therefore\ (x-c)^2+y^2=(u-c)^2+v^2,\ x^2+y^2=a^2,\ u^2+v^2=b^2\ldots\ \ldots\ldots.(1,\ 2,\ 3).$$

$\tan\theta=\dfrac{y}{x-c}$, $\cot\theta=\dfrac{v}{u-c}$, $\therefore \dfrac{y}{x-c}=\dfrac{u-c}{v}$. $\therefore yv=(x-c)(u-c)$..........(4.)

(2) and (3) in (1) and (4) gives, $2c(x-u)=a^2-b^2$, ...(5),

$(a^2-x^2)(b^2-u^2)=(x-c)^2(u-c)^2$........................(6). (5) in (6) gives

$\{4a^2c^2-(a^2-b^2)^2-4cu(a^2-b^2)-4c^2u^2\}(b^2-u^2)=(a^2-b^2+2uc-2c^2)(u-c)^2$.

$\therefore (74175-520u-16u^2)(3600-u^2)-(4u-95)^2(u-40)^2$.

$\therefore 32u^3-2840u^2+825u+3157375=0$. Let $u=z+\frac{355}{12}$.

$\therefore z^3-\frac{249575}{96}z+\frac{164676875}{3456}=0$.

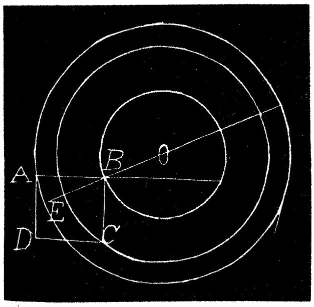
This equation has three roots.

$\therefore z_1=23.02208$, $z_2=36.23197$, $z_3=-58.43863$.

$\therefore u_1=52.60541$, $u_2=65.81530$, $u_3=-28.85530$.

$\therefore x_1=69.35541$, $x_2=82.56530$, $x_3=-12.10530$.

$\therefore y_1=9.47772$, $y_3=68.94535$.



The first values satisfy the problem in question; the second must be rejected as not admissible; while the third values satisfy the problem for the point within the field.

$\therefore$ area $ABCD=(x-c)^2+y^2=951.5672$ square chains$=95.15672$ acres.

When the point is within field, area$=(x-c)^2+y^2=7468.424$ square chains$=746.8424$ acres.

Also solved by *O. W. ANTHONY.*

34. **Proposed by THOS. U. TAYLOR, C. E., M. C., Department of Engineering, University of Texas, Austin, Texas.**

Given a variable parallelogrom *ABCP*, where *P* remains fixed. *A* moves on an irregular plane curve (closed) and *C* moves on another irregular plane curve (closed) whose plane is parallel to the plane of (*A*) curve. The generator *PC* moves completely around and returns to its initial position, *AB* always moving parallel to *PC*, and, of course, returns to its initial position. If distance between planes (*A*) and (*C*)$=h$, show by elementary mathematics and without using theorem of Koppe that volume of solid generated by variable parallelogram $ABCP=\frac{1}{2}h$ (area generated by $AP+$area generated by BC).

No solution of this problem has been received.

PROBLEMS.

38. **Proposed by F. M. PRIEST, Mona House, St. Louis, Missouri.**

Suppose two cylindrical iron shafts, each 6 inches in diameter and respectively, 20 and 40 feet in height, are both standing perpendicular at the sea level. They start to fall in still air, how long will it require each one to fall to a horizontal position ?